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ABSTRACT

Setting unresolved technical issues aside, there are three other changes that are needed before e-learning realizes its fullest potential. First, the basic mental model of what e-learning is must be expanded. Second, the quality of assessment within e-learning products must be improved. Third, there must be rigorous evaluation of e-learning initiatives. This paper first discusses the different mental models of e-learning, depending on the person's relationship to it. It then focuses on new directions in e-learning assessment and describes an example of alternative assessment in e-learning, specifically the innovative assessment approaches found in the e-learning courseware developed by LearnWright of Rockville, Maryland. Finally, discussion moves to ways advancements in assessment strategies lead to better evaluation of e-learning. (AEF)

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Enhancing E-Learning Assessment and Evaluation Strategies

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Mental Models of E-Learning

E-learning has gone through a major reality check since the global economic downturn of the last two years. Fortunately, it has survived, unlike web-based grocery delivery and any number of other "hot" ideas for e-businesses. Some have argued that once e-learning developers work out technical kinks such as interoperability standards and security issues, the e-learning enterprise will attain even the most optimistic forecasts for changing the way people learn in the 21st Century (Rosenberg, 2001; Schank, 2001).

Setting the unresolved technical issues aside, there are three other changes that are needed before e-learning realizes it fullest potential. First, we must expand our basic mental model of what e-learning is. Second, we must improve the quality of assessment within our e-learning products. Third, we must get serious about investing in rigorous evaluation of e-learning initiatives.

Cognitive psychologists define mental models as conceptions of systems or phenomenon that we construct in our minds (Gentner & Stevens, 1983). A person might have a good mental model of how an internal combustion engine runs, but a weak one of how microware works. Mental models are important cognitive structures that influence how people react to change and solve problems. They are often based on analogies or metaphors (Norman, 1983). For example, when people first began using word-processing software more than twenty years ago, they usually thought of word-processors as analogous to typewriters. A mental model of word-processing as similar to typing worked in some ways, but failed in others, such as when novice users continued to hit return at the end of every line of text rather than relying on the word-wrap function. Today's learners, for whom typewriters are as unfamiliar as slide rules, do not suffer from such misconceptions when learning how to word-process.

People also have different mental models of e-learning, depending on their relationship to it and their experiences with it. Commercial vendors of products such as learning management systems and multimedia authoring software frequently promote a mental model of e-learning as media events using terms such as "full motion video" and "dynamic learning objects." Instructional designers are more likely to describe e-learning by referring to instructional activities analogous to traditional training events such as "presentations," "discussions," and "quizzes." Subject matter experts, by contrast, tend to formulate a mental model of e-learning as an alternative vehicle for distributing content via "electronic books" or "real time databases."

Rather than as technologies, activities, or content collections, a mental model of e-learning can be based upon the concept of "outcomes." Outcomes are achieved objectives; they are the evidence

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that learning has occurred, performance has changed, and results have been attained. Outcomes assessment has been a major movement in education for at least a decade, reflecting a general shift from an emphasis on teaching to a focus on learning (Huba & Freed, 1999; Marzano, Pickering, & McTigh, 1993).

In the business world, a mental model of e-learning as outcomes will encourage a sharper focus on the ultimate goals of e-learning, namely performance and results. After all, what are the ideal outcomes of e-learning if not performances tied closely to the mission and goals of the organization that yield desirable results such as greater profitability, better safety records, or larger market share?

Another benefit of thinking of e-learning as outcomes is that it forces us to consider how we will certify that the outcomes have been achieved. In other words, the nature and quality of assessment becomes paramount in a mental model of e-learning as outcomes.

New Directions in E-learning Assessment

Assessment, defined as the activity of measuring learning, is still a relatively weak component of most e-learning programs (Schank, 2001). In fact, vendors, instructional designers, and subject matter experts alike appear to struggle with conceiving of assessment as anything more than a multiple-choice test. Despite the sophisticated multimedia features of many e-learning programs, a closer look at the assessment strategies in these programs suggests that developers, perhaps limited by today's still primitive authoring systems to highly predictable algorithms, often fall back upon overly simplistic multiple-choice test items that primarily measure low-level retention of isolated facts.

This is not adequate. The knowledge workers of the 21st Century workplace are rarely confronted with clearly delineated choices from which they must select; instead they must generate original solutions to unique problems. Traditional multiple-choice tests cannot tap into the critical ability to frame and resolve ill-defined problems. Fortunately, a few good examples of alternative assessment in e-learning for business and industrial training are emerging.

In this paper, we describe one such example, specifically the innovative assessment approaches found in the e-learning courseware developed by LearnWright of Rockville, Maryland, USA (www.learnwright.com). LearnWright specializes in the development of training for regulated industries such as pharmaceutical companies. One type of e-learning developed by LearnWright is Good Manufacturing Practices (GMP) training that is mandated by the U.S. Food and Drug Administration (FDA). LearnWright GMP courseware includes a number of innovative performance assessment strategies such as:

- AUDIT CAM ("What's wrong with this activity?")
- AUDIT CVR ("What's wrong with this conversation?")
- AUDIT DOC ("What's wrong with this document?")

The screen capture in Figure 1 illustrates a typical assessment approach used in the LearnWright GMP courseware. This assessment item presents the learner with multiple comprehension and application challenges. The learner must first watch a brief video that illustrates the performance of a worker in a pharmaceutical manufacturing environment. The learner is then required to locate performance problems in the video, specify the nature of the problem, and finally, identify the specific type of GMP regulations violated in this problem. In terms of outcomes, this type of item engages multiple types of higher-order cognitive processes including classification, interpretation, abstraction, application of rules, and judgment.

GMPinterCam - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address
Correct! Not wearing gloves is a problem. Taking samples without gloves can cause contamination of the material being sampled. The type of contamination most likely to happen would be from:
particulates.
microbes/bacteria.
physical objects.
other chemicals.
VIRTUAL AUDIT TOOL
Done

Figure 1. Virtual Audit Tool in GMP Training developed by LearnWright.

One of the distinctive features of this type of assessment is that it blends assessment with learning. In traditional training, assessments are usually distinct activities clearly separated from instructional events. For example, after trainees have attended a number of classes, they are given some sort of examination. Or, after a worker reads a given number of screens in an e-learning program, he or she is linked to a quiz. However, a major advantage of e-learning environments is that assessment activities can be embedded unobtrusively into the interactive structure of the program themselves. As described above, the assessments developed by LearnWright provide excellent examples of this approach. Learners are engaged in a series of increasingly complex problems, complete with detailed guidance and feedback. These interactive learning activities blend naturally with the virtual audit tools for activities, documents, and conversations that are integral to workplace performance.

Figure 2 illustrates how LearnWright has moved its interactive training products from a traditional e-learning model whereby instruction (usually in the form of didactic presentations) is separated from assessment (usually in the form of simple multiple choice questions) to an enhanced model whereby instruction (in the form of increasingly sophisticated simulations) is

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blended seamlessly with assessment (in the form of Virtual Audit Tools and performance assessments). A major advantage of the approach illustrated in Figure 2 relates to "alignment," probably the most important characteristic that should be evident in thinking of e-learning as outcomes. Alignment is evident when there is a clear degree of synchronicity among learning objectives, content, the tasks in which learners are engaged, technological features, and assessment strategies. Many of the flaws in existing e-learning programs stem from a lack of alignment.

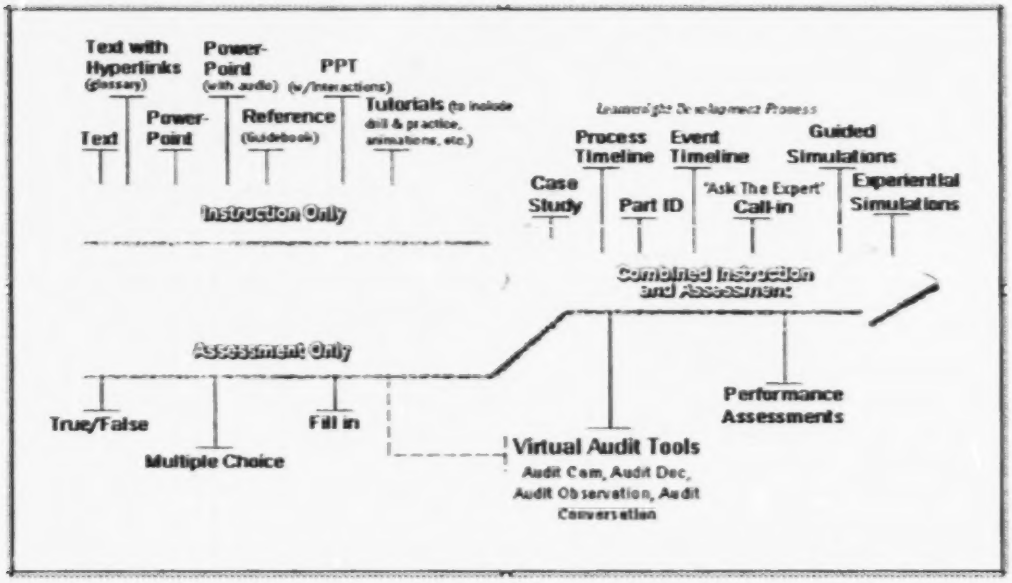

Figure 2. LearnWright models of instruction and models of assessment.

For example, consider the integration of Web resources into an e-learning course that might be offered in a higher education context. Such courses often provide access to extended digital resources such as electronic journals, real time databases, and online discussion forums that students are expected to utilize to enhance their learning. But academic developers are often disappointed by the degree to which learners actually use these and similar online resources. However, learners may simply perceive that these resources have little relationship with assessments in the course (such as writing a paper or taking a final exam), and so they "wisely" choose to target their cognitive efforts on those learning activities that they perceive as more clearly aligned with attaining the highest scores on assessments. After all, students are only human, and although course developers might wish that students will access all resources simply because of the desire to learn, they are more likely to use only the resources that have obvious links to assessments. Clarification of the alignment within e-learning courses is an important role for evaluation specialists. Unfortunately, many e-learning development teams neglect to include evaluators (either internal or external), and so alignment goes unchecked.

Assessment in e-learning programs can have multiple roles ranging from narrow, formative purposes (Did the learners master the skills to be learned in one section of the program, indicating their readiness to proceed to the next section?) to broad, summative ones (Do successful e-learners perform on the job in ways that contribute to institutional success?). The development of assessment strategies in e-learning should be guided by a common set of questions such as:

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- What is the purpose of the assessment, e.g., formative (to provide information for helping someone learn) or summative (rendering a judgment of a learner's competence)?
- What is the scope of the assessment, e.g., a quiz administered within an individual module or a final assessment of learners to certify that they are ready to be awarded a license or certification?
- What is being assessed, e.g., knowledge, skills, attitudes, mental models, or higher order thinking capacities?

Outcomes come in many forms. Some are psychomotor involving specific physical skills such as the proper way to lift a box by bending at the knees. Some are affective such as the motivation to show up at work on time or pitch in when there is a crisis. Many are cognitive, ranging from knowledge of simple concepts and rules to robust mental models such as a deep understanding of Good Manufacturing Practices (GMP) within the pharmaceutical industry or the commitment to safety in any workplace.

Corporations are increasingly concerned with higher order outcomes such as problem-solving, ethics, creativity, and commitment. The latter are much harder to assess, and most authorities advocate basing assessments upon a range of indicators rather than seeking one precise measure. Instead of asking "what test should we use?," e-learning designers should ask themselves "what can we possibly count as evidence that learners have attained these higher order outcomes?" Assessments of complex outcomes such as ethical reasoning inevitably require a variety of indicators to "triangulate" them.

LearnWright has adopted the following guiding principles in developing assessment strategies for its e-learning products:

- If it hasn't been assessed, it hasn't been learned.
- The closer the assessment tool is to how the job is performed, the more valid the assessment is as a predictor of how the person will perform on the job.
- Reliable, valid, and authentic assessments serve multiple purposes:
    - improve learner performance,
    - improve courseware quality,
    - improve organizational effectiveness,
    - qualify training performance to other stakeholders (e.g., regulatory agencies and consumers), and
    - foster better evaluation.

Better Assessment Can Lead To Better Evaluation

Although the terms are often used interchangeably, assessment and evaluation actually have two distinct meanings (Worthen, Sanders, & Fitzpatrick, 1996). Assessment is defined as the activity of measuring learning whereas evaluation involves judging the effectiveness and worth of programs and products. In short, we assess people and evaluate things. The terms are often confused, perhaps because the same data can be used for both functions. An exam in an e-learning course in a professional continuing education context can be used to assess student learning and provide the basis for awarding certification. The same exam results, however, might be used to evaluate the effectiveness of a course, especially if other versions of the course are available for comparison.

Advancements in assessment strategies are being made as evidenced by the cutting-edge outcome assessments created by LearnWright described above. Although we readily acknowledge that there is other creative work being done in e-learning assessment elsewhere (Rossett, 2001;

Schank, 2001), the state-of-the-art of assessment in general is almost as weak as the state-of-the-art of e-learning evaluation.

What is the basis for this claim? According to the American Society for Training and Development, evaluation lags behind because most e-learning programs are only evaluated at the lowest level of Kirkpatrick's classic evaluation model, simply finding out if learners like e-learning (Rossett, 2001). But if developers and their clients begin to think of e-learning as outcomes, not only will assessments improve, but attention to higher levels of evaluation will follow because we shall be able to more easily address questions such as:

- Do learners master the desirable knowledge, skills, and attitudes?
- Do learners transfer their new learning to performance in the workplace?
- Does enhanced performance contribute to the bottom line such as higher profits?
- Given positive results, what was the return-on-investment for e-learning?

These are the evaluation levels that are sorely needed in the rapidly evolving world of e-learning (Reeves & Carter, 2001). Changing our mental model of e-learning to one focused on outcomes is a step in the right direction toward improving both assessment and evaluation. But more than a cognitive change is required. The e-learning industry as a whole must commit to more realistic investments in evaluation of its products. Amazing advances emerge almost weekly from the pharmaceutical field, primarily because of the extensive research and development that industry supports. For the e-learning industry to realize analogous results, we must invest at least ten percent of our funding in multiple levels of evaluation. There is no time better to start this level of investment than now.

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